CHAPTER 11

TANK CAR OPERATIONS

Section I. Tank Cars and Facilities

TANK CARS

When rail facilities are available, tank cars may be used along with the pipeline to transport petroleum products. Each tank car should be used to carry only one grade of product. If this is not possible, the tank car must be inspected and cleaned between loads to avoid product contamination. Tank cars vary in capacity and design. Those used for petroleum products usually have one compartment and range in capacity from 6,000 to 16,000 gallons. Other tank cars have more than one tank compartment and carry more than one product at a time. Tank cars vary from those designed for narrow-gage foreign service to those designed for broad-gage foreign service and standard-gage domestic service. Some tank cars have heaters to liquefy viscous products, but those without heaters are generally used. Figure 11-1 shows a typical petroleum tank car. The dome, safety valve, and bottom outlet of tank cars are described below.

Figure 11-1. Typical petroleum tank car

Dome

Each tank car compartment has a dome as shown in Figure 11-2, page 11-2, to allow space for the product to expand as the temperature rises. The tank shell can be filled to the top. Each dome has a manhole through which the tank car may be loaded, unloaded, inspected, cleaned, and repaired. Dome covers may be hinged and bolted on or screwed on. Most domes have vents and safety valves to let out vapors.

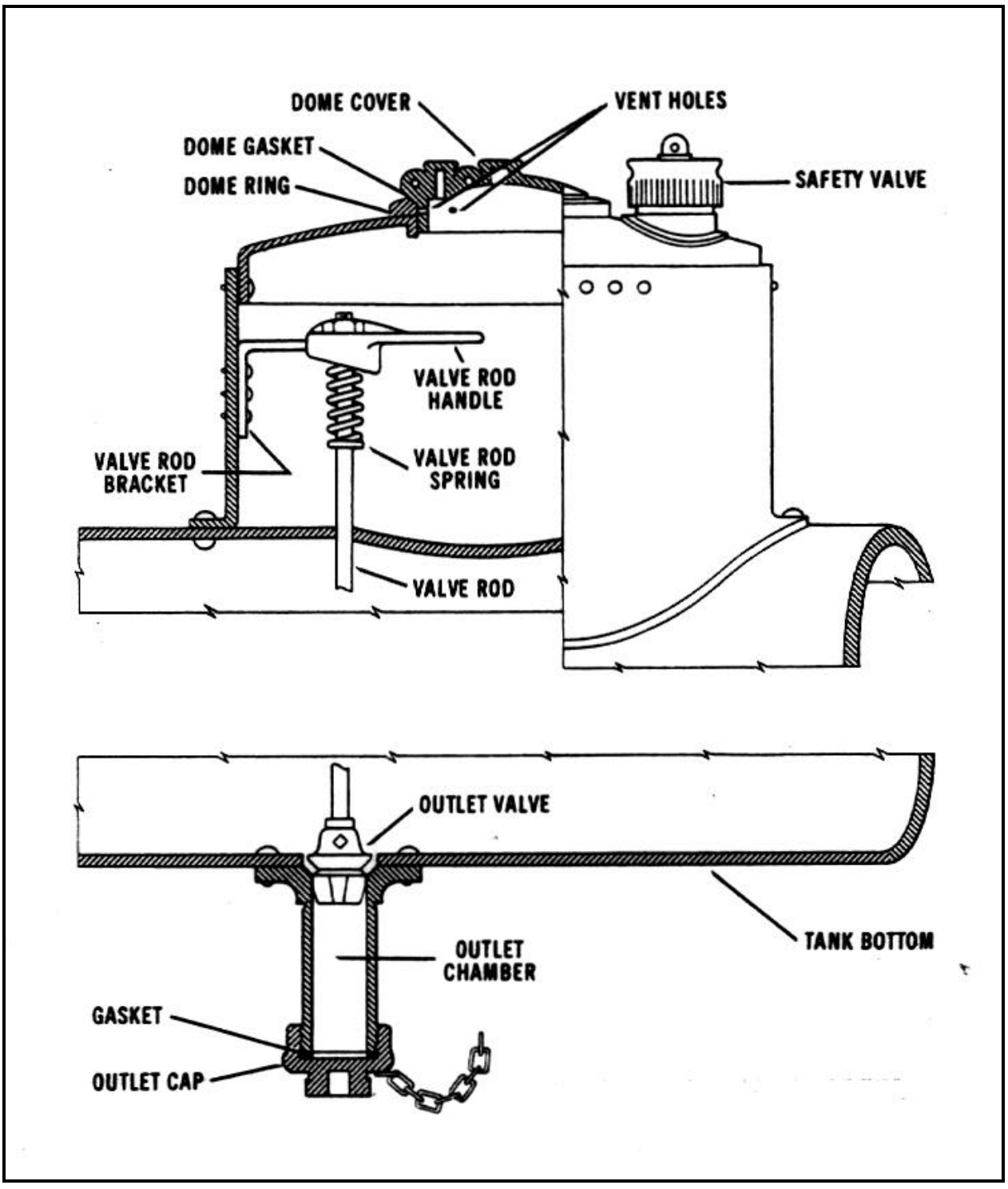

Figure 11-2. Tank car dome and bottom outlet

Safety Valve

The safety valve used on most tank cars consists of a spring-loaded poppet valve which opens at a preset pressure. As pressure in the dome builds up to a point above the pressure setting of the valve, the valve is forced off the valve seat. This lets the excess vapors escape. The spring closes the valve automatically when the pressure drops to a level equal to the valve setting.

Bottom Outlet

Each tank car has a bottom outlet and is usually loaded and unloaded through it. The outlet valve as shown in Figure 11-2, page 11-2, is controlled by a valve rod handle or valve rod handwheel. The outlets on tank cars used in the United States are 5 inches in diameter. Outlets on tank cars used overseas are generally 4 inches in diameter. All outlets have male threads. A tank car elbow assembly is used to adapt a pump suction line to the 5-inch outlet. A 5- to 4-inch adapter must be installed between the elbow assembly and the tank car 5-inch outlet.

LOADING AND UNLOADING SITES AND FACILITIES

Engineer personnel construct standard loading and unloading facilities. The equipment at these facilities includes pumps, manifolds, grounding items, and fire-fighting items. Portable pumping assemblies may be used in undeveloped theaters. This chapter deals mainly with the use of portable pumping assemblies for loading and unloading tank cars. However, the same procedures and safety precautions apply to all tank car operations.

SITE

Certain factors must be considered and provided for when choosing and preparing a site. Consider these factors.

- The site should be at least 100 feet from any building.
- The site should have adequate drainage.
- If tank cars are to be unloaded by gravity, the site must be elevated enough to have the proper flow at the receiving container
- If tank cars are to be loaded by gravity, the loading site must be below the supply container.
- A spur track or bypass should be provided for loading and unloading tank cars.
- The track at the site should be level so that product in all parts of the tank car remains level. This allows for accurate gaging and keeps air and fuel from being trapped at one end of the car.
- If a tank truck is used to load or unload a tank car, it should be grounded to one or more ground rods to guard against static electricity or stray current.
- A grounding cable should be permanently bolted between the track rails.
- Derails, which are wedge-shaped devices of wood or metal, should be placed at the head of the car. They prevent other cars from backing into the tank car during transfer operations. Also, they are placed on the rails to prevent the tank car from rolling.

FACILITIES

Loading and unloading facilities should be arranged so that several tank cars can be serviced at the same time. Each servicing point at a facility should have bonding cables to bond the servicing point to the tank car shell and to the track. There should be an emergency valve some distance from the loading and unloading point. This valve is used to cut off the flow through the line in case of fire. In some cases, product will flow by gravity to a loading and unloading facility from bulk storage tanks or pipelines. In other cases, fixed or portable pumping units must be used to transfer the product. Other equipment at the facility is described below.

- Distribution Manifold. A distribution manifold made of pipes and valves extends along a loading and unloading facility. It provides outlets for servicing several tank cars at one time. The manifold must be grounded. Cables must be available to bond the manifold to the track and to the tank car.

•Car Mover.. There should be a standard car mover for spotting tank cars at each loading and unloading facility.

•Electrical Equipment. Electrical equipment includes lights, switches, and motors. They must be explosion-proof and in good working order.

•Outlet Plug. A wooden cone-shaped plug for the bottom of the tank car should be available in case of emergency.

•Gossler Coupling**.** The Gossler coupling allows a tank car to be bottom loaded or unloaded at any NATO facility. The coupling adjusts to fit any tank car bottom outlet or elbow and, with adapters, fits various hoses. Figure 11-3 shows the Gossler coupling.

Figure 11-3. Gossler coupling

PRECAUTIONARY MEASURES

Certain precautionary measures must be taken when a tank car is loaded or unloaded. Included among these measures are the following:

•NO SMOKING signs must be placed so as to ensure that there is no smoking within 100 feet of the transfer operation.

•No welding, open flames, or lights, other than explosion-proof flashlights or lanterns, are allowed within 100 feet of the transfer operation.

•The carrying of matches, lighters, or open lights is prohibited.

•All loading and unloading equipment must be bonded and grounded.

Section II. Procedures for Loading Tank Cars

PRELIMINARY PROCEDURES

A number of procedures must be followed before tank cars are loaded. They are described below.

Sampling and Gaging

Take a sample of the product that is to be transferred to the tank car. Visually inspect it to make sure the product has no unusual appearance. If the identity or quality of the product is in question, test the product to make sure it meets specifications before the transfer operation is started. Also, gage the contents of the supply tank, and record the data. Take a water cut from the supply tank using water-indicating paste. Drain any water before the product is transferred.

Inspecting Loading Equipment

Inspect pumps, hose, pipelines, and manifolds to see that they are clean and in good operation condition. When possible, use equipment to handle only one product. If more than one product must be handled by the same equipment, make sure all previous product is thoroughly drained before a new product is handled.

Spotting Tank Car

Spot a tank car by using the following procedures.

- Make sure the track rails are properly bonded and grounded. Ensure that cable connections are secure and make bare metal-to-metal contact.
- Position the tank car so that there will be no unnecessary strain on the hose connections.
- Set the brakes and block the wheels of the tank car to keep it from moving during loading operations.
- Set and lock derails.
- Place STOP--TANK CAR CONNECTED signs between the rails at least 25 feet and preferably 50 feet ahead of and behind the tank car or group of tank cars. Place the signs so that they can be seen by switch crews on the main line next to the spur track. The signs should be at least 12 by 15 inches with black letters on a yellow background. The word STOP should be in 4-inch letters. The words TANK CAR CONNECTED should be in 2-inch letters.
- Place at least two fire extinguishers near the tank car where they will be in easy reach.
- If there is no permanent ground rod, drive a 4- to 5-foot iron rod into the ground beside the tank car. Attach a ground wire between the tank car and the rod. Soak the ground around the rod with water.
- If a tank car manifold is used, bond it to the tank car shell.
- When several rail cars are awaiting service, position cars with like products together (all MOGAS together, all JP-8 fuel together, and all aviation fuel together).
- Place NO SMOKING signs in the area where they can be easily seen.

Removing Dome Cover

Stand on the windward side of the dome when releasing internal pressure or when removing the dome cover. Remove the dome cover as follows.

- Clean all dirt from around the dome cover.
- Raise the safety valve on the dome to see if there is pressure in the tank. Reduce any pressure in the tank by keeping the safety valve open.
- Remove the padlock or seal that secures the dome cover.
- Loosen the dome cover slowly to permit any remaining pressure to escape through vents in the cover. If the tank car has a screw cover, place a bar between the cover lug and the dome knob. Unscrew the cover two

complete turns or until the vent openings are exposed. If the car has a hinge-and-bolt dome cover, loosen the nuts enough to release internal pressure.

- Remove the dome cover.

Inspecting Tank Car

Inspect the tank car to determine if it is suitable to receive the product. Follow these steps.

- Make sure that the product last carried in the tank is the same product that is to be transferred to the tank. If the product is not the same, follow the procedures in MIL-HDBK-200.

- Inspect the inside of the tank visually from the outside through the dome to make sure it is clean. If there is rust, sand, scale, dirt, or residue, the tank must be cleaned before it is filled. Only authorized persons familiar with procedures for cleaning tanks should enter the tank. See Chapter 12 for tank cleaning procedures.

- Look for any foreign objects, such as tools, bolts, or old tank car seals, that may have fallen into the tank. Such objects should be removed only by authorized persons. Some objects may not contaminate the product, inspect the tank for residual product. Any residual product must be removed before the tank is filled.

- Inspect the inside and outside of the tank visually from the outside to make sure there are no holes, cracks, leaks, or loose plates. See that the tank is properly mounted to the underframe and that the tank is safe and roadworthy.

- Inspect the dome, dome cover, and safety valve to make sure they work and are in good condition. Make sure that the vent holes in the dome cover are open and clean.

- Make sure the bottom outlet chamber is in good condition.

- Ensure that the outlet valve seats and seals properly. Place a container under the bottom outlet chamber to catch drainage. It should stay there until the transfer is complete. Open and close the outlet valve several times with the valve rod handle or handwheel located in the dome. If the valve does not seat properly, replace the valve gasket or repair the valve. In an emergency , load the tank car without repairing the outlet valve. However, report it so that personnel at the installation receiving the tank car will unload it through the dome. The valve should then be repaired as soon as possible. When the outlet valve is operating, close it.

- If necessary, tank cars may be flushed with a small amount of the product to be loaded. This will remove traces of previous product, rust, and scale from the outlet sump.

Removing Bottom Outlet Cap

Make sure the outlet valve is seated before removing the bottom outlet cap. Remove the bottom outlet cap as follows:

- Remove the bottom outlet cap with the tank car wrench. If the cap does not unscrew easily, tap the cap lightly in an upward direction with a wooden mallet or block. Let any product in the outlet chamber drain into the drainage container.

- Open the outlet valve to allow any residual product to drain into the container. Close the outlet valve, but do not replace the outlet cap until the car is completely loaded.

- Dispose of any product in the container, and place it back under the outlet valve.

BOTTOM OUTLET LOADING

Tank cars should always be loaded through the bottom outlet. This prevents vapor loss. It also reduces static electricity and the chance of product contamination. Precautions and procedures for loading a tank car through the bottom outlet are as follows:

- Place a pumping unit at least 50 feet from the tank car.

- Make sure the pumping unit is properly grounded.

- Make sure that the supply container is properly grounded and vented.

•Make sure the hoseline connections are not laid on the ground without a dust cap or plug. It could result in contamination of product.

•Connect the pump suction line to the outlet of the supply container.

•Attach the tank car elbow or Gossler coupling to the tank car outlet. Connect the pump discharge hose to either the elbow or the coupling. The tank car elbow is a part of the tank car loading facility and the FSSP.

•Station someone on the windward side of the dome to signal when the full mark is reached.

•Open the following valves before starting the pump:

••Outlet valve of the supply container.

••Pump valves necessary to permit flow through the pump.

••Tank car bottom outlet valve.

••Manifold valves, when a manifold is used.

•Start the pump following these precautions and steps.

••If spills occur while loading, stop the pump and cover the area with a blanket of foam from a foam fire extinguisher. If there is no foam fire extinguisher in the area, cover the spill with sand or dry earth. Remove contaminated earth and dispose of it according to current regulations.

••If sparks are seen while the car is being loaded, stop the pumps at once and check all bonding and grounding connections. All connections should have bare metal-to-metal contact.

••If the bad connection cannot be found, check the power equipment in the area for stray current. Correct any faulty condition.

••In the event of enemy attack, electrical storm, or fire, stop the transfer operation. Disconnect the pump discharge hose and tank car elbow. Replace the bottom outlet cap. If time permits, move the car out of the danger zone, set the brakes, and ground the car.

••In case of a fire at a hinged dome, stop loading and close the dome. In case of a fire at a screw dome, throw a wet tarpaulin or blanket over the dome or use a carbon dioxide or foam fire extinguisher.

••If the loading operation is stopped for any reason, disconnect the pump discharge hose.

••Check the contents of the tank often to avoid overfilling. However, never put your head in the dome.

••When the product level is near the full mark in the tank car, signal the pump operator to reduce pump speed and get ready to stop the pump. When a loading system that has a control valve is used, reduce the product flow by partially closing the valve. If the tank does not have a full mark, load the tank until the product reaches the top of the shell. When the tank is full, stop the pump, close all the valves, and disconnect the pump discharge hose.

DOME LOADING

A tank car should be loaded through the dome only when bottom loading is not possible. If the tank car must be loaded through the dome, follow these steps.

•Place a pumping unit at least 50 feet from the tank car.

•Make sure the pumping unit is properly grounded.

•Make sure the supply container is properly grounded and vented.

•Make sure the hoseline connections are not laid on the ground without a dust cap or plug. This could result in contamination of product.

•Connect the pump suction line to the outlet of the supply container.

•Put the end of the loading hose or drop tube through the dome of the tank until it almost touches the bottom of the tank. Bond the hose or drop tube to the tank. Make sure the end of the loading hose or drop tube remains submerged in the product in the tank during loading. If the hose or tube does not extend far enough into the tank,

product will splash and vaporize. Splashing also causes static electricity. Make sure there is no strain on the hose that would cause it to move or come out of the tank.

- Open the following valves before the pump is started:
  - Outlet valve of the supply container.
  - Pump valve to allow flow through the pump.
  - Loading rack outlet valve when a loading rack is used.
  - Manifold valves when a manifold is used.
- Make sure all the connections are secure, and start the pump following these precautions and step.
  - Check for leaks at the bottom outlet when product starts to flow into the tank. If there are leaks, stop the pump and try to seat the bottom outlet valve by turning the valve rod handle clockwise. If the leak continues, stop loading, recover the product from the tank, and clean up any spills.
  - If spills occur while loading, stop the pump and cover the area with a blanket of foam from a foam fire extinguisher. If there is no foam fire extinguisher in the area, cover the spill with sand or dry earth. Dispose of contaminated earth according to current regulations.
  - Stop the pumps at once and check all bonding and grounding connections if sparks are seen while the product is being loaded. All connections should have bare metal-to-metal contact. If the bad connection cannot be found, check the power equipment in the area for stray current. Correct any faulty condition.
  - Stop the transfer operation in the event of enemy attack, electrical storm, or fire. Then disconnect the pump discharge hose and tank car elbow, and replace the bottom outlet cap. If time permits, move the car out of the danger zone, set the brakes, and ground it.
  - Stop loading and close the dome if there is a fire at a hinged dome. In case of a fire at a screw-type dome, throw a wet tarpaulin or blanket over the dome or use a carbon dioxide or a foam fire extinguisher.
  - Remove the hose or drop tube from the tank if loading is stopped for any reason.
  - Check the contents of the tank often to avoid overfilling. However, never put your head in the dome.
  - Signal the pump operator to reduce pump speed, and get ready to stop the pump when the product level is near the full mark in the tank car. When using a loading rack or other system that has a control valve, reduce the product flow by partially closing the valve. If the tank does not have a full mark, load the product until it reaches the top of the tank shell. When the tank is full, stop the pump and close all the valves. Carefully remove the loading hose or drop tube from the tank to avoid spills.

FOLLOW-UP PROCEDURES

Certain follow-up procedures must be performed after a tank car is loaded. They are as follows:

- Allow the product to stand for at least 15 minutes so that suspended water or sediment can settle.
- Gage and sample the contents of the tank. Take the temperature of the product, volume correct the quantity according to DA Pamphlet 710-2-2, and record the data. Keep the sample for reference until the tank is delivered.
- Drain any water or sediment from the tank.
- Compare the amount of the product issued from storage tanks with the amount loaded on the tank cars after the daily closing gages are taken. Report excessive loss to the proper authority.
- Replace the bottom outlet cap. Close and lock the dome cover when the tank car is full of product.
- Place an approved identification seal on the dome cover. If the seal is in place, the receiver is assured that no one has tampered with the car. Record the seal marking on all the shipping papers.
- Remove the drainage tub from under the bottom outlet. Properly dispose of any product that is in the tub.
- Remove any DANGEROUS-EMPTY signs, and replace them with FLAMMABLE signs.
- Disconnect the grounding wire from the tank car. Remove the derails, if used, and remove the TANK CAR CONNECTED signs.

•Release the brakes, and move the car from the transfer area.

Section III. Procedures for Unloading Tank Cars

PRELIMINARY PROCEDURES

Certain procedures must be followed before tank cars are unloaded. The procedures to follow are given below:

Inspecting Receiving Containers

When inspecting receiving containers, you will need to follow certain procedures. These procedures are as follows:

•If the product in the tank car is to be transferred to cans or drums, inspect the cans or drums to make sure they are cleaned in good condition.

•If the product in the tank car is to be transferred to a tank truck or semitrailer, inspect the vehicle tanks as you would tank car tanks.

•If the product in the tank car is to be transferred to storage tanks, make sure the storage tanks are suitable to receive the assigned product.

•If a receiving tank already has product in it, gage and sample the tank contents. Make sure there is enough outage in the tank to receive the product. Visually inspect the sample to make sure the product in the receiving tank is the same as the product in the tank car. If there is any doubt, have tests made to verify the grade and quality of the product before mixing it with a new product. Gage the tank again, and record the data.

•Make sure that the receiving tank is grounded and vented.

Inspecting Unloading Equipment

Inspect pumps, hose, pipelines, and manifolds to see that they are clean and in good operating condition. When possible, use equipment to handle only one product. If more than one product must be handled by the same equipment, make sure all previous product in it is thoroughly drained before new product is pumped.

Spotting Tank Car

A number of procedures are performed when spotting a tank car. These procedures are described in Section II. In addition, the following procedure apply to loading tank car.

•Checking Seals and Car Numbers. Make sure the tank car is in the right place by comparing the car and seal numbers with those on the shipping papers. Make sure the seals and locks are intact. Notify the proper authority if cars arrive with broken seals or locks. If there is an emergency and the tank car is needed immediately, unload the tank car but do not use the product until it has been tested.

•Removing Dome Cover. Pry the seals loose, and remove the dome cover. If the safety valve is not working, high pressure may develop in the tank car in hot weather. If time permits, relieve the pressure by letting the car cool overnight. Relieving the pressure by venting allows product to vaporize. It also causes a fire hazard.

TANK CAR INSPECTION

A number of procedures must be followed when inspecting a tank car. Follow these steps.

•Inspect the tank car for leaks through the shell and the bottom outlet. If there are any signs the car is leaking, schedule it to be unloaded at once. Place containers to catch leaking product, and clean up any spills.

•Gage and sample the contents of the tank car, and check the sample for appearance and color. Take the temperature of the product, volume correct the quantity according to DA Pamphlet 710-2-2, and record the data. Slowly drain any water in the tank through the bottom outlet. After the water is removed, gage the contents again, volume correct the quantity according to DA Pamphlet 710-2-2 and record the data. Fuel that is cloudy or off-color may be contaminated. Any questionable product should be thoroughly tested before it is unloaded.

•Make sure the bottom outlet chamber is in good condition and the outlet valve is working properly (if it is used for unloading). In cold weather, water in the tank may freeze around the outlet valve and cause it not to work. To free the frozen valve, apply steam, hot water, or hot cloths to the outlet chamber. A hot air duct tent heater or a slave kit may be used by trained personnel, when authorized, to thaw the outlet. Let the valve thaw in the warm part of the day, when possible.

SAFETY PRECAUTIONS

A tank car should be unloaded through the bottom outlet. The tank car may be unloaded through the dome only when it is impossible to unload it through the bottom outlet. When unloading a tank car through either the bottom outlet or the dome, follow these safety precautions:

•If spills occur while unloading, stop the pump and cover the area with a blanket of foam from a foam fire extinguisher. If there is no foam fire extinguisher in the area, cover the spill with sand or dry earth. Dispose of contaminated earth according to current regulations.

•If sparks are seen while the car is being unloaded, stop the pumps immediately and check all bonding and grounding connections. All connections should have bare metal-to-metal contact. If the bad connection cannot be found, check the power equipment in the area for stray current. Correct any faulty condition.

•In case of enemy attack, electrical storm, or fire, stop the transfer operation. Disconnect the pump suction hose and tank car elbow, and replace the bottom outlet cap or remove the drop tube or hose. If time permits, move the car out of the danger zone, set the brakes, and ground the car.

•In case of a fire at a hinged dome, stop unloading and close the dome. In case of a fire at a screw-type dome, throw a wet tarpaulin or blanket over the dome or use a carbon dioxide or a foam fire extinguisher.

•If loading is stopped for any reason, disconnect the pump suction hose or remove the hose or drop tube from the tank.

BOTTOM OUTLET PROCEDURES

Certain procedures must be followed to unload a tank car through the bottom outlet as shown in Figure 11-4, page 11-11. These procedures are as follows:

•Place the pump at least 50 feet from the tank car. Ground the pump.

•Measure the diameter of the bottom outlet of the tank to make sure the connection can be made with available adapters.

•Turn the valve rod handle or handwheel clockwise to make sure the outlet valve is seated. Place a drain tub under the bottom outlet, and leave it there until the operation is completed.

•Loosen the bottom outlet cap one or two turns. This permits product trapped in the outlet chamber to run into the drain tub. If the cap does not unscrew easily, tap it lightly in an upward direction with a wooden mallet or a block. Do not unscrew the cap completely. If flow from the outlet does not slow down after about 15 seconds, the outlet valve is not seated properly. In such a case, tighten the outlet cap and try to seat the valve properly. Unload the tank car through the dome if the valve cannot be seated. When drainage from the outlet slows to a drip, remove the outlet cap.

•Attach the tank car elbow or Gossler coupling to the tank car outlet. Use the necessary adapters, and connect the pump suction line to the tank car elbow or the coupling.

•Connect the pump discharge line to the inlet of the receiving container.

•Dispose of drainage collected in the drainage tub, and put the tub back in place.

•Place the dome cover over the manhole by propping it up with a block of wood under the edge. This allows air to enter the tank as the product is unloaded.

•Open the bottom outlet valve when all connections are secure.

•Open the proper valves in the line, and start the pump.

•Watch for leaks around all connections when the product starts to flow. If there are leaks, stop the pump and make repairs before starting the pump again.

•Wait until all the product has been unloaded from the tank. Let the pump drain the suction line, and then stop the pump. When the suction line is empty, the engine speed will increase noticeably.

•Close the inlet valve of the receiving container immediately after shutting down the pump so that product will not drain back into the line.

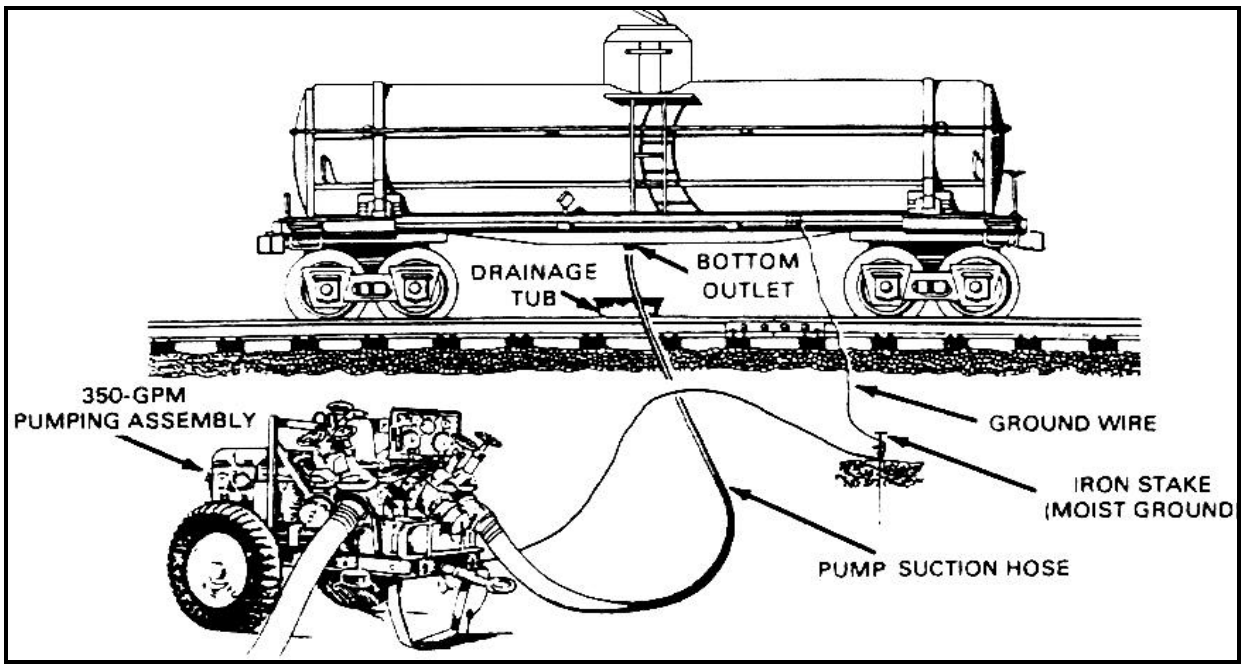

Figure 11-4. Unloading tank car through bottom outlet

DOME UNLOADING

Certain procedures must be followed when unloading a tank car through the dome as shown in Figure 11-5, page 11-12. These procedures are as follows:

•Place the pump at least 50 feet from the tank car. Ground the pump.

•Place a drainage tub under the bottom outlet.

•Put the end of the unloading hose through the tank dome until it almost touches the bottom of the tank. Keep the hose below the surface of the product until the tank is completely unloaded.

•Connect the pump discharge line to the inlet of the receiving container.

•Place the dome cover over the manhole so that it rests against the hose and allows enough space for venting.

•Open the proper valves in the line, and start the pump.

•Watch for leaks around all connections when the product starts to flow. If there are leaks, stop the pump and make repairs before starting the pump again.

•Wait until all the product has been unloaded from the tank car. Let the pump drain the suction line, and then stop the pump. When the suction line is empty, the engine speed will increase noticeably.

•Close the inlet valve of the receiving container immediately after shutting down the pump so that the product will not drain back into the line.

•Remove the bottom outlet cap, if possible, and drain the product from the outlet chamber into the drainage tub.

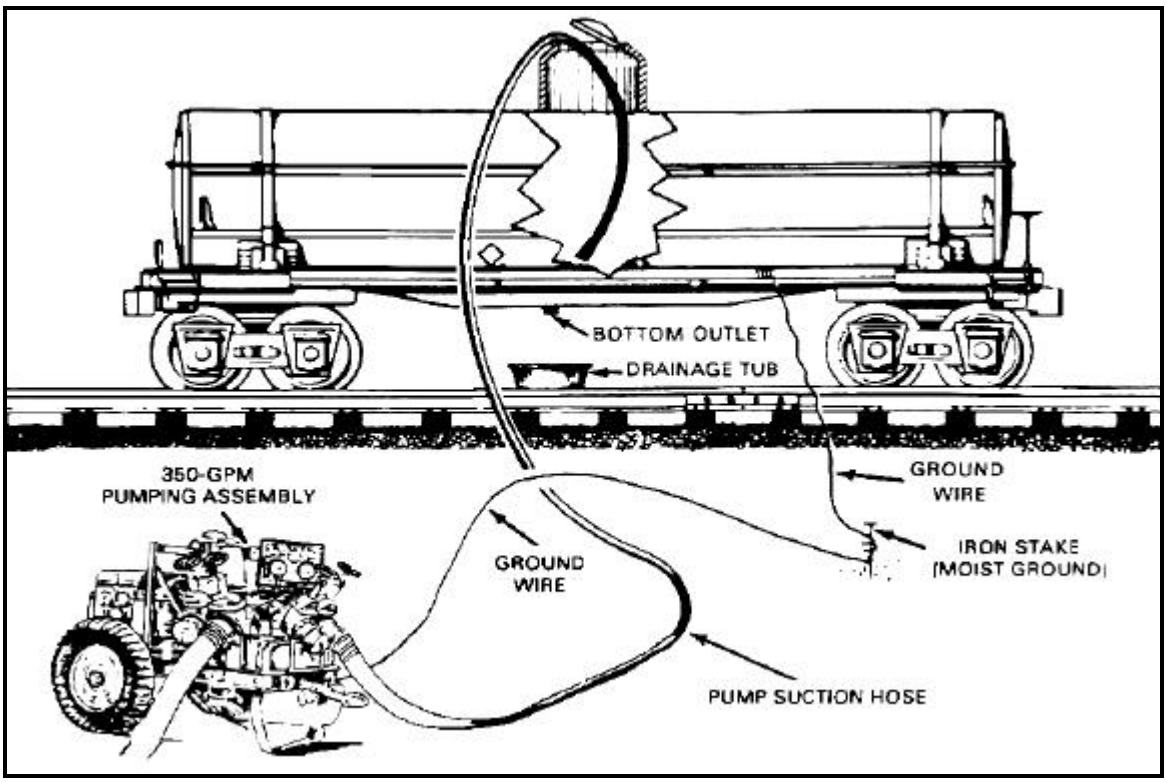

Figure 11-5. Unloading tank car through dome

FOLLOW-UP PROCEDURES

Certain follow-up procedures must be performed after a tank car is unloaded. These procedures are as follows:

- Make sure the tank car is completely empty.
- Gage and sample the product in the receiving tank, volume correct the quantity according to DA Pamphlet 710-2-2, and record the data. Compare the amount of the product delivered to the receiving tank with the amount of the product taken from the tank car. Report excessive loss to the proper authority. Allow enough time for water and particles to settle in the receiving tank. Drain the water from the receiving tank, gage the contents again, and record the data.
- Remove the unloading hose or drop tube from the tank car.
- Close and unlock the dome cover. Remove the drainage tub, and discard any product in the tub.
- If the tank car has FLAMMABLE signs, replace them with DANGEROUS EMPTY signs.
- Disconnect the ground wire from the tank car, and remove the derails, if used.
- Remove the TANK CAR CONNECTED signs.
- Release the brakes, and move the car from the transfer area.
- Notify the proper authority that the tank car is empty and that it is to be removed and reloaded.
- Report any defective car to the proper authority.